

RIGHT FLOORING



RIGHT BUILDING

Selecting the best-fit acoustical flooring solutions for today's diverse building portfolio



floorfolio
COMMERCIAL FLOORING

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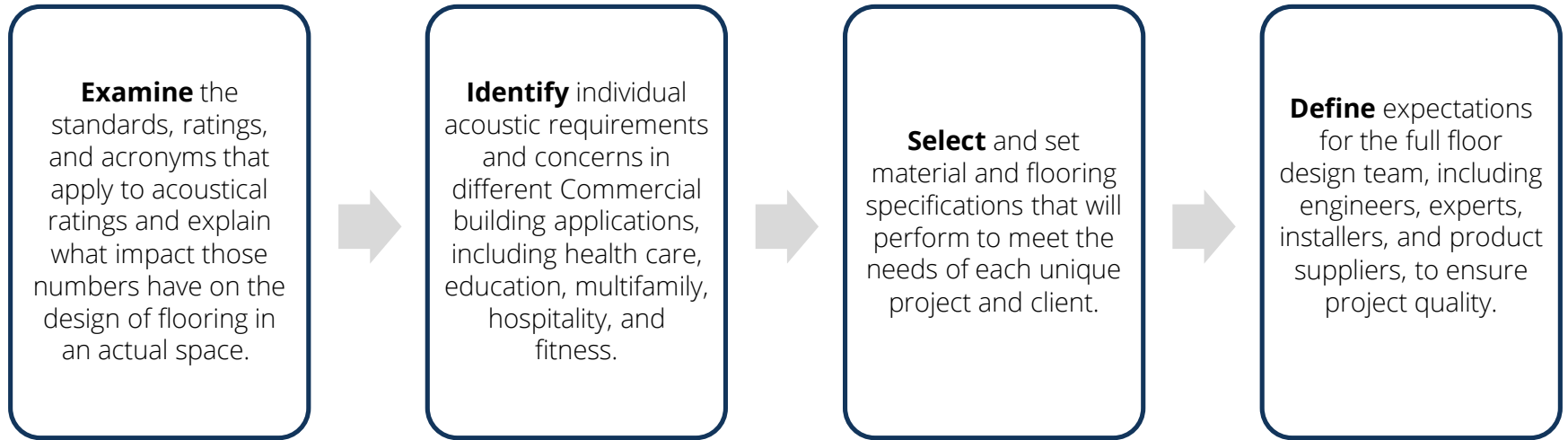
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Learning Objectives



A decorative graphic on the left side of the slide consists of a fan of wooden planks. The planks are arranged in a semi-circular arc, fanning out from the top left towards the bottom right. They have a light brown, natural wood grain texture. The background of the entire slide is a solid dark blue color.

SECTION 1

Understanding Sound Basics
and Ratings



Understanding Sound Basics and Ratings

Why are acoustics important?

"The control or behavior of sound in buildings, the acoustic performance, should be considered as important as keeping the rain out, providing adequate ventilation, and maintaining the internal spaces at the correct temperature."

-Nick Fordy, Woodhouse Workspace

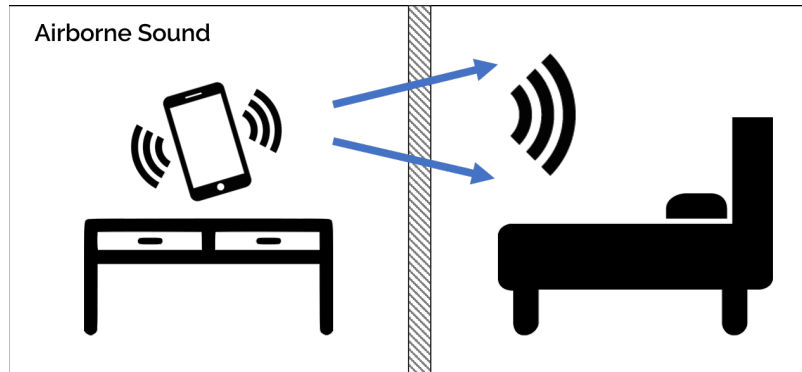
Understanding Sound Basics and Ratings



Sound isolation in construction systems separating occupied spaces in all types of buildings is a necessity.

Understanding Sound

Basics and Ratings



The ABCs of Sound Terminology

Common acronyms and terms associated with sound:

- **Airborne sound** — sound that arrives at the point of interest, such as one side of a partition, by propagation through air.
- **Impact insulation class (IIC)** — a single-number rating derived from measured values of normalized impact sound pressure levels, in accordance with Annex A1 of ASTM E 492, when measured under controlled laboratory conditions. It provides an estimate of the impact sound insulating performance of a floor/ceiling assembly. This is the amount that impact sound produced by a standard tapping machine striking the top surface of a floor/ceiling assembly is reduced when it is measured in the room below.
- **Apparent impact insulation class (AIIC)** — a single number rating obtained by applying the classification procedure of ASTM E 989 to apparent impact transmission loss data. The apparent impact insulation class provides a measure of the impact sound reduction provided by the complete floor/ceiling system, including flanking.
 - Please note that FIIC, or Field impact insulation class, was changed by ASTM to AIIC.

Understanding Sound Basics and Ratings

The ABCs of Sound Terminology

Common acronyms and terms associated with sound:

- **Flanking transmission** —airborne or structure-borne sound transmission that bypasses the separating wall or floor/ceiling and travels through other building elements such as the floor, ceiling or walls abutting the separating wall or ceiling. Flanking transmission can also occur through joints or penetrations in the assembly.
- **Noise isolation class (NIC)** —a single-number rating calculated in accordance with ASTM Classification E 413 using measured values of noise reduction. It provides a measure of the sound isolation (including flanking) between two enclosed spaces that are acoustically connected by one or more paths. The NIC includes the sound reduction provided by the assembly being tested, the effects of absorption in the receiving room and the effects of flanking. For field testing of airborne noise isolation, a measurement of noise isolation class should be performed.

Understanding Sound Basics and Ratings

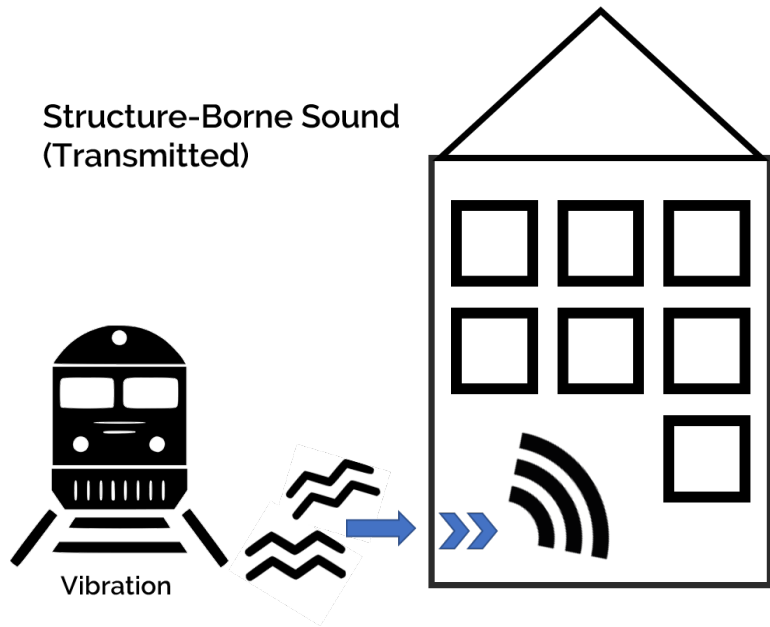
The ABCs of Sound Terminology

Common acronyms and terms associated with sound:

- **Normalized impact sound rating (NISR)**—the impact sound rating normalized to a reference absorption equivalent to a receiving room that has a reverberation time of 0.5 seconds. For field testing of impact sound insulation where no furnishings are present, a measurement of normalized impact sound rating test should be performed. The NISR includes the sound reduction provided by the partition, the effects of absorption in the receiving room (assuming that the receiving room had a reverberation time of 0.5 seconds) and the effects of flanking.
- **Normalized noise isolation class (NNIC)**—a single-number rating for noise isolation between two rooms both less than 150 cubic meters calculated in accordance with ASTM Classification E 413 using measured values of normalized noise reduction. The noise reduction values are normalized to an equivalent receiving room absorption that would be achieved with a reverberation time of 0.5 seconds. The NNIC includes the sound reduction provided by the partition, the effects of absorption in the receiving room (assuming that the receiving room had a reverberation time of 0.5 seconds) and the effects of flanking. For field testing of airborne noise isolation where no furnishings are present, a measurement of normalized noise isolation class should be performed.

Understanding Sound Basics and Ratings

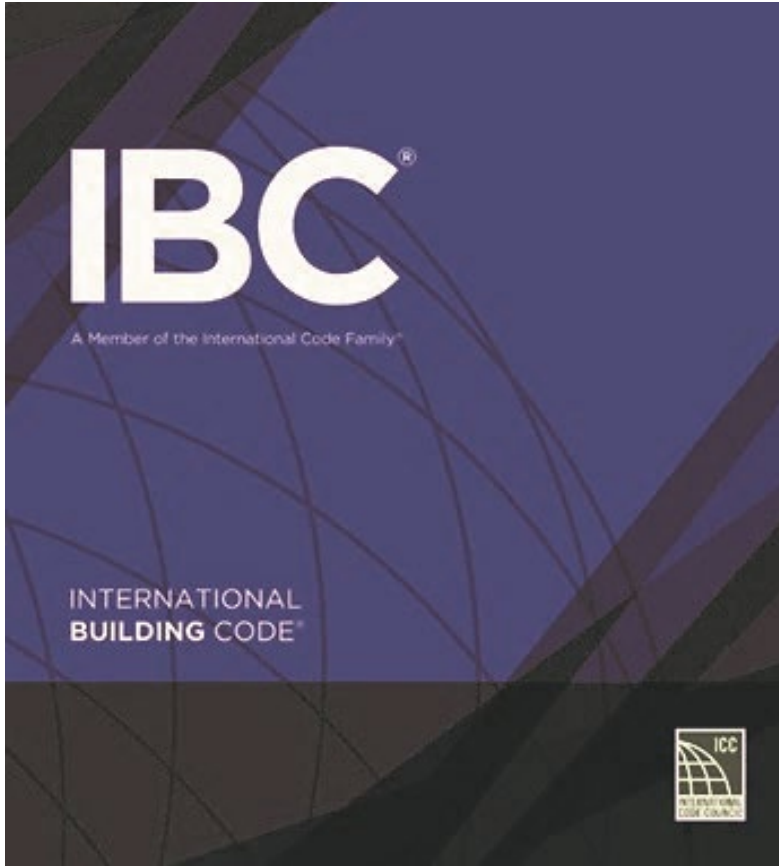
Structure-Borne Sound
(Transmitted)



The ABCs of Sound Terminology

Common acronyms and terms associated with sound:

- **Sound transmission class (STC)** —a single- number rating calculated in accordance with Classification E 413 using values of sound transmission loss. It provides an estimate of the sound reduction provided by an assembly tested in a laboratory.
- **Apparent sound transmission class (ASTC)** —a single-number rating obtained by applying the classification procedure of ASTM E 413 to apparent transmission loss data. The apparent sound transmission class provides a measure of the sound reduction provided by the complete building system, including flanking but not receiving room absorption.
- **Structure-borne sound** —sound that arrives at the point of interest, such as the edge or face of a partition, by propagation through a solid structure.



Understanding Sound Basics and Ratings

Understanding the Standards in Acoustics

IBC

The International Building Code (IBC-2003) has mandated that all floor/ceiling assemblies between dwelling units have a minimum 50 IIC when tested in accordance with ASTM E492 or a minimum 45 AICC rating of not less than 45 when tested in accordance with ASTM E1007.

Understanding Sound Basics and Ratings



Acoustic Testing

ASTM E492

Standard Test Method For Laboratory
Measurement Of Impact Sound Transmission
Through Floor-Ceiling Assemblies Using The
Tapping Machine

- This test method covers the laboratory measurement of impact sound transmission of floor-ceiling assemblies using a standardized tapping machine.



Understanding Sound Basics and Ratings

Acoustic Testing

ASTM E90

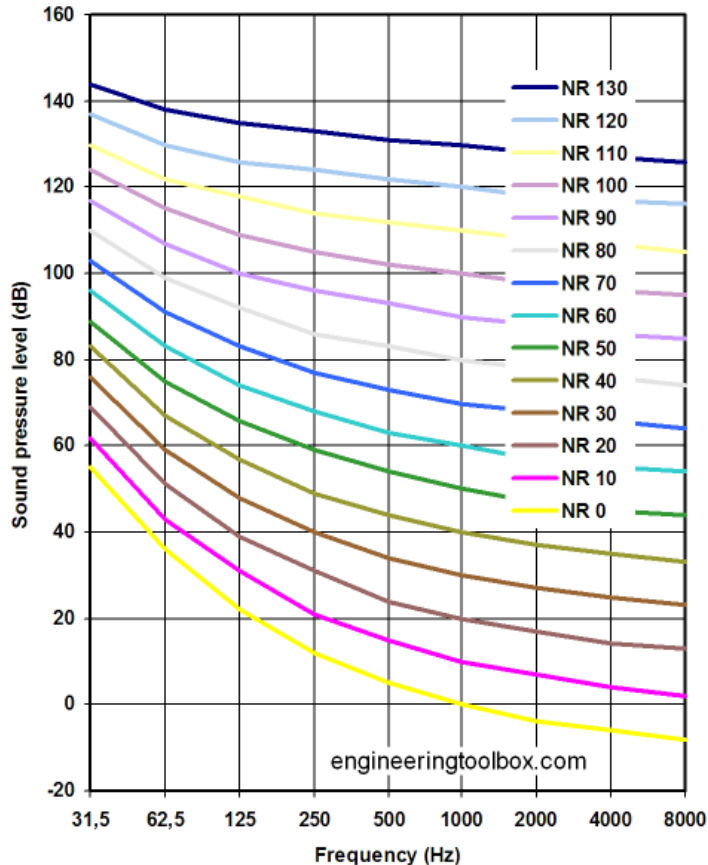
- This test method covers the laboratory measurement of airborne sound transmission loss of building partitions such as walls of all kinds, operable partitions, floor-ceiling assemblies, doors, windows, roofs, panels, and other space-dividing elements.

Understanding Sound Basics and Ratings

Acoustic Testing

ASTM E336

- This test method defines procedures and metrics to assess the sound isolation between two rooms or portions thereof in a building separated by a common partition or the apparent sound insulation of the separating partition, including both direct and flanking transmission paths in all cases.
- Measurements and ratings reported include noise rating (NR), noise isolation class (NIC), normalized noise reduction (NNR), normalized noise isolation class (NNIC), apparent transmission loss (ATL), and apparent sound transmission class (ASTC).



Understanding Sound Basics and Ratings

Acoustic Testing

ASTM E1007

Standard Test Method for Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures

- This test method covers the field measurement of impact sound transmission through floor-ceiling assemblies in buildings. The data obtained from this test is used to calculate the impact sound rating (ISR), the normalized impact sound rating (NISR) and apparent impact isolation class (AIIIC) rating in accordance with ASTM E989.



Understanding Sound Basics and Ratings

Acoustic Testing

ASTM E492

- Standard Test Method
For Laboratory
Measurement Of Impact
Sound Transmission
Through Floor-Ceiling
Assemblies Using The
Tapping Machine



Understanding Sound Basics and Ratings



Acoustic Testing

ASTM E2179

Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors

- This test method describes a method for the laboratory measurement of the effectiveness of floor coverings in reducing impact noise from a standard tapping machine through concrete floors.
- Please note: Delta is used on 6" concrete slabs and does not apply to other slab thicknesses

Understanding Sound Basics and Ratings

What impact should those numbers have on the design of the flooring in an actual space?

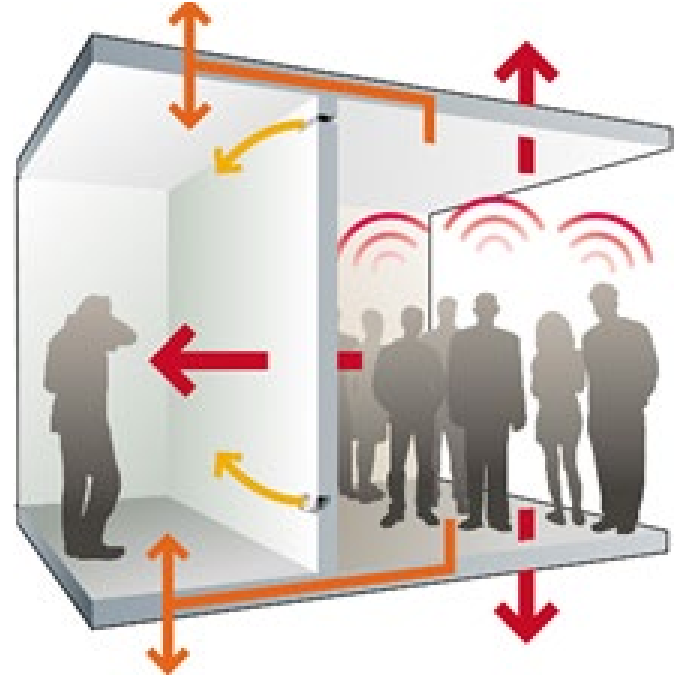
Understanding Sound Basics and Ratings

What impact should those numbers have on the design of the flooring in an actual space?

STC – Sound Transmission Class

- Determines **airborne** sound transmission loss for frequencies between 125 and 4,000 Hz.
- The higher the STC rating the greater the effectiveness of a material or construction to reduce the transmission of airborne sound.

WARNING: It is common for specifiers to request an STC rating, which has nothing to do with floor to ceiling sound migration.





Understanding Sound Basics and Ratings

What impact should those numbers have on the design of the flooring in an actual space?

STC – Sound Transmission Class

Quantifying STC in Real Terms:

- 25 – Normal speech can be understood quite clearly
- 30 – Loud speech can be understood fairly well
- 35 – Loud speech is audible but not intelligible
- 45 – Loud speech is very faint
- 50 – Loud speech is not audible, but amplified sound will be audible
- 60 – Minimum requirement for amplified sound



Understanding Sound Basics and Ratings

What impact should those numbers have on the design of the flooring in an actual space?

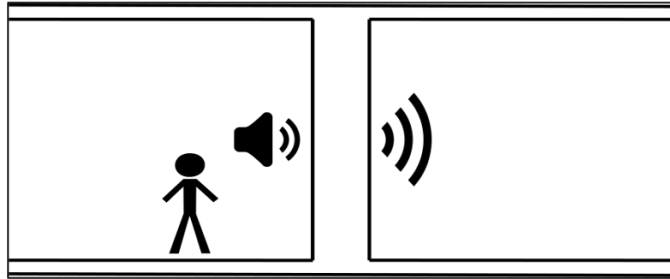
IIC – Impact Insulation Class

- IIC is used to determine the amount of **impact** noise isolation.
- The higher the IIC rating, the more effective the floor or ceiling assembly is at isolating **vibrations** and at absorbing **impact** sound, such as steps from someone walking on the floor above.

Understanding Sound Basics and Ratings

STC

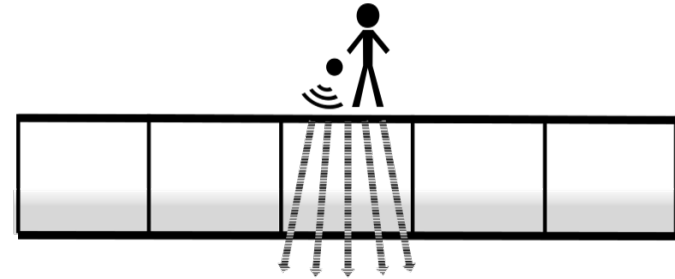
Sound Transmission Class



VS.

IIC

Impact Insulation Class



What impact should those numbers have on the design of the flooring in an actual space?

Understanding Sound Basics and Ratings

What impact should those numbers have on the design of the flooring in an actual space?

DELTA IIC (ΔIIC)

- This rating shows what the product **adds** to the assembly (6" concrete slabs only), in terms of impact sound isolation.



IIC 6" SLAB & FLOOR COVERING

—



IIC 6" SLAB

= ΔIIC



Understanding Sound Basics and Ratings

"...Using IIC (AIIIC) and STC (ASTC) results to represent the sound deadening ability of an underlayment without describing, in detail, the whole floor/ceiling assembly causes confusion at all levels of the marketplace and is ultimately misleading to the consumer.

The only way to accurately compare the sound deadening characteristics among underlayment materials using IIC/AIIC and STC/ASTC testing is to keep all other components in the test assembly constant, i.e., the same floor covering material, the same thickness and density of concrete (or composition of wood sub-floor), and the same suspended ceiling assembly. "

-Dale Tucker, Vice President, FloorFolio Industries

A decorative graphic on the left side of the slide consists of a fan of wooden planks. The planks are arranged in a semi-circular arc, fanning out from the top left towards the bottom right. They are a medium brown color with a visible wood grain. The background of the entire slide is a dark blue, textured surface that resembles water or a fine fabric.

SECTION 2

Different Commercial Building
Types and Their Acoustic
Requirements

Different Commercial Building Types and Their Acoustic Requirements



Building Types

Unique Needs = Unique Concerns



Different Commercial Building Types and Their Acoustic Requirements

Building Types

Retail

- Malls
- Shopping centers
- Pad sites

(all definitions courtesy Certified Commercial Property Inspectors Association)



Different Commercial Building Types and Their Acoustic Requirements

Building Types

Office

- Office Building
- Suite or Condominium
- Medical or Dental Office Suite



Different Commercial Building Types and Their Acoustic Requirements

Building Types

Multi-Dwelling Unit

- Multifamily
 - Mixed use multifamily (commercial space on lower level, residential above)
- Hotel and lodging



Different Commercial Building Types and Their Acoustic Requirements

Building Types

Healthcare

Student Housing

Education

Special-purpose buildings



Different Commercial Building Types and Their Acoustic Requirements

Making sense of it all...





SECTION 3

Creating Specifications that
Satisfy Flooring Performance
Needs for Individual Projects



Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects

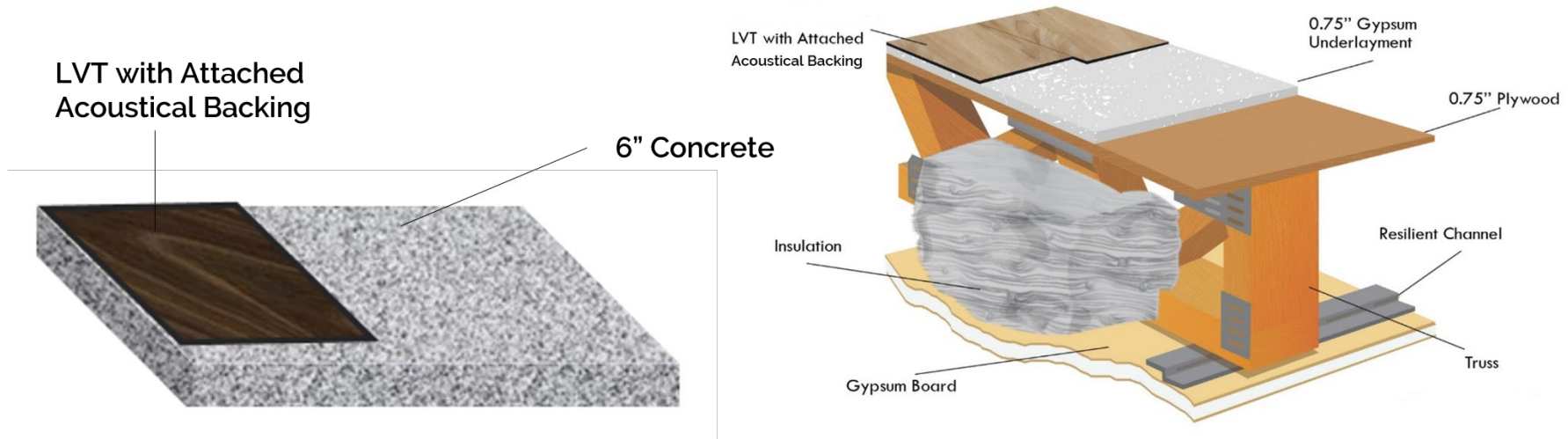
What sets acoustic performance requirements for commercial floors?

- Section 1206 of the 2018 International Building Code (IBC) lists requirements for acoustical performance of walls, partitions, and floor/ceiling assemblies in multi-family buildings.
 - Guidelines exist for acoustical performance in offices, schools, hospitals, and other commercial structures, but they are not requirements under the IBC.
- Multi-family assemblies must have a sound transmission class (STC) rating of 50 and an impact insulation class (IIC) rating of 50.
 - These ratings can be reduced to 45 when field tested.

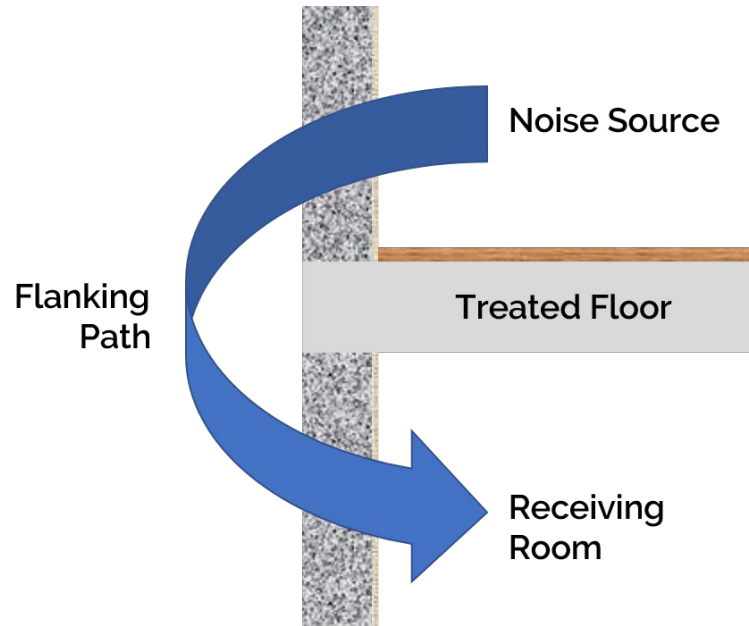
Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects

Should all spaces get the same kind of flooring solution?

Step One: Identify the components of the floor/ceiling assembly

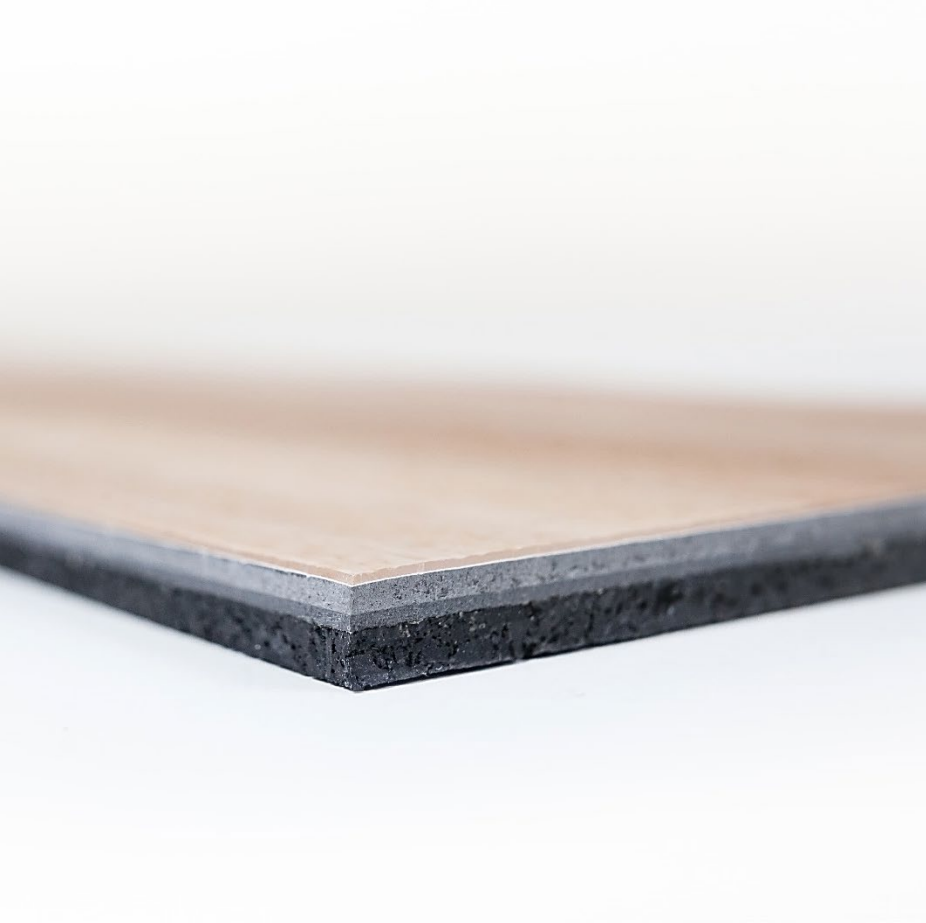


Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects



Should all spaces get the same kind of flooring solution?

Step Two: Reduce or eliminate flanking from other building elements

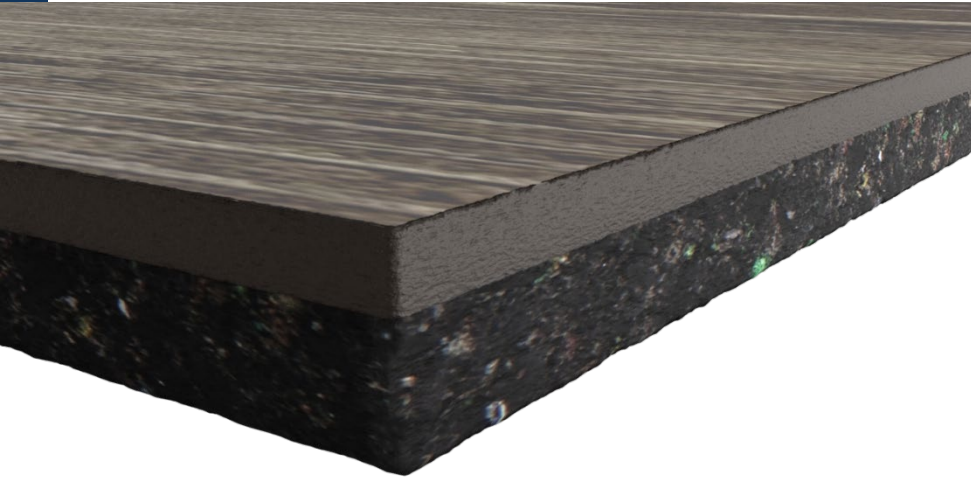


Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects

Should all spaces get the same kind of flooring solution?

Exploring Flooring Solutions

Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects



Should all spaces get the same kind of flooring solution?

General Strategies for Improving Acoustic Performance in Wood Truss Floor/Ceiling Assemblies

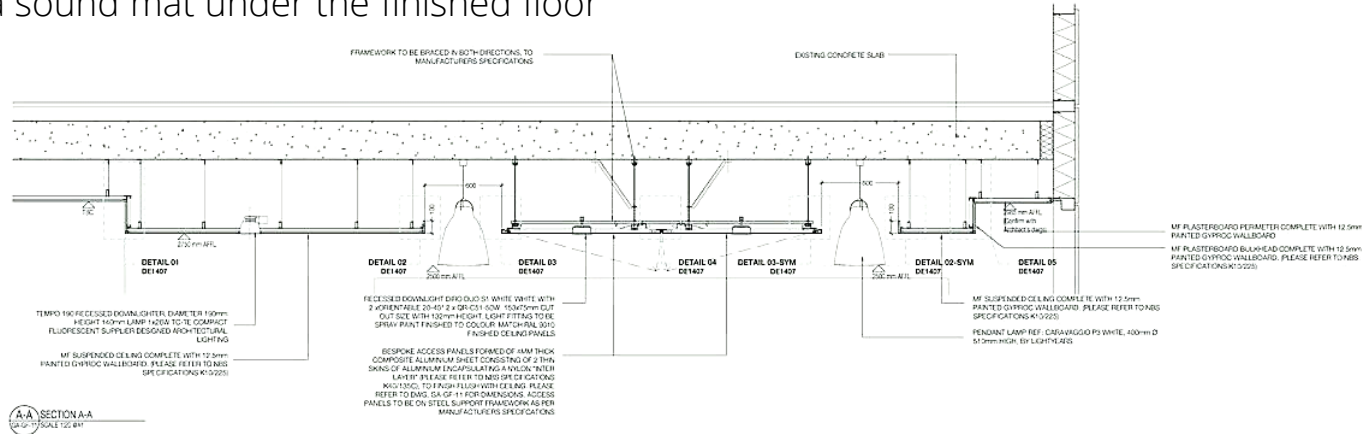
- Placement of gypcrete and sound mat
- Upgrading the composition of the rubber underlayment
- Changing the resilient channel to acoustical clips
- Adding an additional layer of drywall in the ceiling
- Additional thickness of gypsum underlayment (gypcrete)

Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects

Should all spaces get the same kind of flooring solution?

General Strategies for Improving Acoustic Performance in Concrete Floor/Ceiling Assemblies

- If using the bottom of the slab above as the ceiling, add a drop ceiling with acoustic tile or drywall
- Add a sound mat under the finished floor



Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects



What flooring options and innovations are available to enhance acoustic performance?

Trends in flooring:

- Attached underlayment

Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects



What flooring options and innovations are available to enhance acoustic performance?

Advantages of attached underlayment technology:

- Quality control at point of manufacturing, rather than in the field
- Single cost

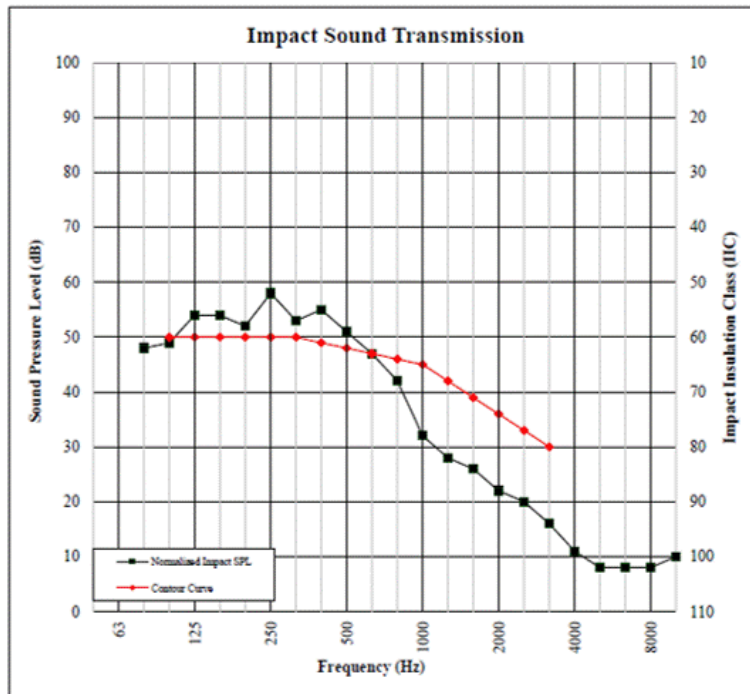
Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects



What flooring options and innovations are available to enhance acoustic performance?

Advantages of attached underlayment technology:

- Single installation
- Single warranty



Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects

What flooring options and innovations are available to enhance acoustic performance?

Advantages of attached underlayment technology:

- Guaranteed acoustic performance



Creating Specifications that Satisfy Flooring Performance Needs for Individual Projects

What flooring options and innovations are available to enhance acoustic performance?

Advantages of attached underlayment technology:

- Secured performance + design flexibility



Case Study

Home Recording Studio

Los Angeles, California



Case Study

Home Recording Studio

Los Angeles, California

With an innovative flooring solution combining 3mm vinyl plank permanently attached to a 3mm acoustical rubber underlayment in manufacturing, Neal was able to build the perfect home studio for a fraction of the price , preserving his music and decreasing sound transmission.

"This is a breakthrough product for anyone looking to isolate sound." -
Neal Daniels



SECTION 4

Setting Expectations to Achieve
Success



Setting Expectations to Achieve Success

How manufacturers can help achieve success...

- Early manufacturer involvement means better solutions.
- Early agreement on goals between architects, designers, and the engineering team helps deliver the correct finished product.
- Select a manufacturer that designs with acoustic performance at the forefront of their product.
 - Combination systems eliminate unknown variables that could reduce acoustic performance.



G2253.07-113-11-R2



IMPACT SOUND TRANSMISSION
ASTM E 492

Freq (Hz)	Background SPL (dB)	Absorption (m²)	Normalized Impact SPL (dB)	95% Confidence Limit	Number of Deficiencies
80	39.8	16.9	48	3.3	-
100	32.2	12.7	49	1.2	0
125	32.2	10.9	54	1.8	4
160	29.0	8.8	54	2.3	4
200	24.1	11.7	52	2.3	2
250	25.4	10.7	58	2.8	8
315	22.4	9.9	53	1.1	3
400	21.4	8.7	55	1.0	6
500	26.1	7.9	51	1.0	3
630	20.9	7.3	47	1.0	0
800	20.5	7.6	42	1.1	0
1000	17.3	7.3	32	0.8	0
1250	15.4	7.2	28	0.9	0
1600	11.0	7.3	26	0.9	0
2000	5.9	8.0	22	0.7	0
2500	5.2	8.9	20	0.7	0
3150	4.4	9.6	16	1.4	0
4000	4.8	10.9	11	1.2	-
5000	5.4	12.7	8	1.7	-
6300	5.9	15.7	8	1.3	-
8000	6.3	20.4	8	1.2	-
10000	6.5	25.6	10	1.7	-

IIC Rating **62** (*Impact Insulation Class*)
Deficiencies **30** (*Sum of Deficiencies*)

Setting Expectations to Achieve Success

Other strategies for success...

- Obtain actual testing results for the products being specified.
- Understand what disclosed testing information means for real-world performance.

Setting Expectations to Achieve Success

How to verify that testing results are real...

Credible sources of data include the following:

- Detailed third-party research reports for generic assemblies that do not employ proprietary materials and systems (e.g., International Code Council Evaluation Services [ICC-ES], National Research Council and Institute for Research in Construction [NRC-IRC]).
- Contemporary test reports from an acoustical testing laboratory that is accredited by the National Voluntary Laboratory Accredited Program (NVLAP)⁴ or International Accreditation Service (IAS).⁵
- Field test reports from qualified acoustical professionals. Construction details, materials, testing methods and a discussion of flanking sound should be included in the report.
- Avoid reference sources where the focus is specific to fire ratings or other non-acoustical issues.





Setting Expectations to Achieve Success

How to verify that testing results are real...

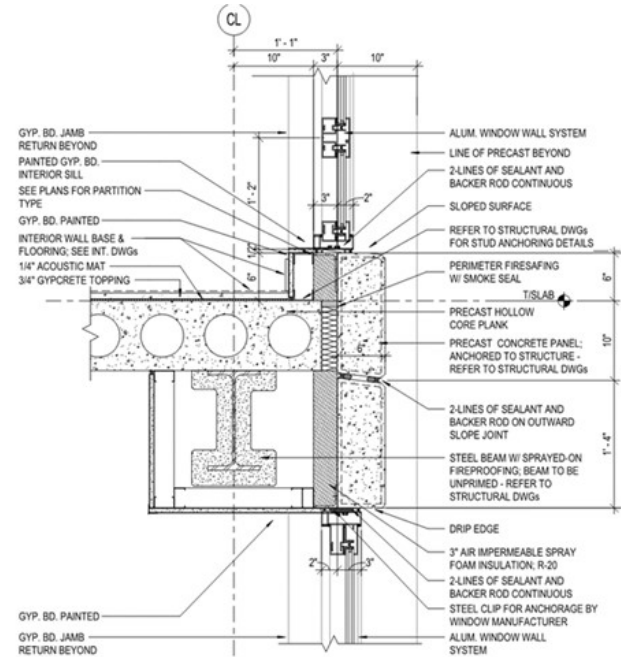
Be skeptical of the following:

- Avoid test summaries that do not include data at all the standard test frequencies.
- Avoid test summaries where the acoustical performance is summarized as a single-number rating within a range of other single-number ratings (e.g., STC 50-54).
- **Avoid test** summaries where the descriptions of acoustically significant material components are given as generic elements (e.g., resilient channel, isolation clip and underlayment/pad) rather than specific components with relevant material characteristics (model number, density, dimensions, mounting procedure, etc.).
- **Avoid referencing** small-sample field tests (e.g., 1 m by 1 m) and field tests with loosely laid materials or those that have not cured for ASTM-specified time periods.

Setting Expectations to Achieve Success

How to verify that testing results are real...

- Ratings are useful for comparison, but are not perfect indicators of performance in the field.
- Knowing all components of the specific flooring assembly tested is critical.
- Ratings are given to an ENTIRE assembly, not an individual material in that assembly.



Setting Expectations to Achieve Success

- Sound-rated assemblies need to be properly designed and specified to perform as expected.
 - A sound-rated assembly is more likely to perform consistently when constructed as described in its laboratory test report.
 - An acoustical laboratory test report should contain a comprehensive description of assembly details, along with acoustical data measured at all the standard frequencies.



G2253.07-113-11-R2
ACOUSTICAL PERFORMANCE TEST REPORT
ASTM E 90 AND ASTM E 492

Rendered to

"COMPANY"

Series/Model: "FLOORINF TYPE"

Specimen Type: Concrete Slab - 203 mm

Overall Size: 3023 mm by 3632 mm

STC	55
IIC	62



Setting Expectations to Achieve Success

Ensuring Long-Term Success

Installation and Maintenance:

- Confirm the permanent HVAC system is on and maintained at specified temperatures.
- Verify tiles are of the same batch and shade.
- Inspect the subfloor condition.



Setting Expectations to Achieve Success

Ensuring Long-Term Success

Installation and Maintenance:

- Conduct moisture testing in accordance with approved standards.
- Conduct an adhesive bond test.



Case Study

Multifamily Development

Lincolnshire, Illinois



Case Study

Multifamily Development

Lincolnshire, Illinois

"The luxury vinyl plank is manufactured with an attached acoustical underlayment that provides sound absorption properties you can't get from standard LVT. The installation with this product will not only deliver tenants a quiet environment, but also years of comfort underfoot."

*-Kevin Micheli, Principal/Director of Predevelopment and
Preconstruction Services, Kinzie Builders*



Conclusions

Hard floor surfaces such as luxury vinyl tile, stone, marble, wood and engineered products have become increasingly popular in multi-family buildings, commercial buildings and healthcare. The challenge is they can be percussive and impact noise has become a major concern.



Conclusions

Examining the standards, ratings, and acronyms that apply to acoustical ratings and the impact those numbers have on the design of flooring in an actual space is critical. Unfortunately, there is much mis-information about testing and when specifying product to meet code.



Conclusions

Understanding testing, ratings, and flooring specifications and how these will perform allows design professionals to identify and meet individual acoustic requirements and concerns in different building applications.



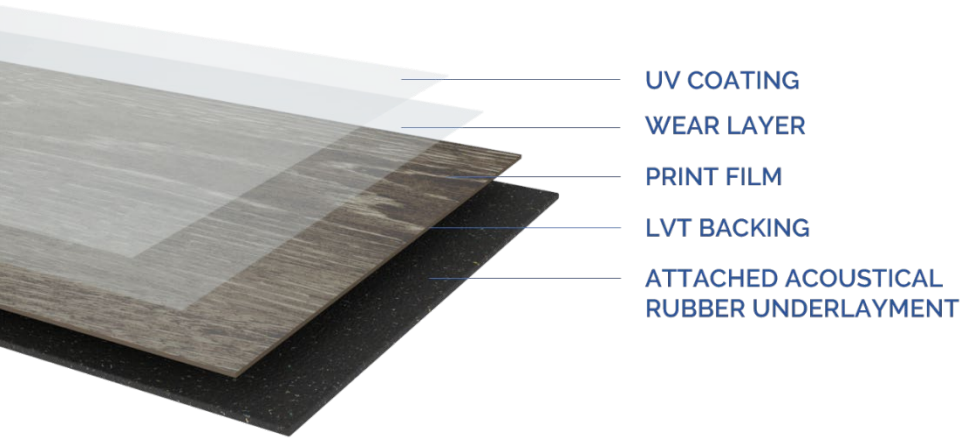
Conclusions

Setting expectations, early on, for the full floor design team ensures project quality.

Conclusions

New flooring innovations are allowing a more streamlined, assured process to meet acoustic requirements.

- Combination systems have an integrated rubber pad already attached to meet sound codes on Dimensional Lumber, Metal Truss, Wood Truss and Concrete floor ceiling assemblies.
- Product saves labor cost by having one installation and one adhesive cost allowing for easy future repairs and longevity of overall installation.



Thank You

This concludes the continuing education unit on the [Right Flooring, Right Building](#) course.

Please take the quiz to receive your credits.

[Thank you for your interest in FloorFolio.](#)

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